Technological Aspects of Designing of Functional Electronics Devices, which are Realization of the Neuron Networks Algorithms

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***Abstract*—In the given publication the possibility of testing the artificial neuron networks structures is explored, depending on the type of the chosen activation function. The precipices of synapses and their influencing are explored on an activation function. The interface of package MatLab is offered and VHDL for automation of process of planning of devices of functional electronics.**

***Index Terms*—communication system planning, logic devices, logic functions, system analysis and design**

I. INTRODUCTION

Constructing and development of devices, devices and systems of functional electronics, in the period of the present is enough actual questions, intensive development all more new technologies, appearance of a new element base (the integrated circuits of high degree of integration) put new requirements in relation to efficiency of technological process of planning and making of the higher mentioned devices.

For today, artificial neuron networks (ANN) are used for the decision of different hardly formalized technical tasks. [1] It is possible to take to such tasks - analysis of testimonies of sensory sensors and other tasks. Basic difficulties, what are linked with the use of ANN - this:

- Necessity of development of knowledge base.

- Narrow-mindedness of entrance data, what is data (knowledge) appear in a numeral kind. In the case of working of the character given or analogue signals which after grow into digital, it is necessary to attract experts on the given subject, and also apply the difficult algorithms of concordance of experts knowledge's and exposure of expert estimations.

Their fast-acting is other aspect ANN. The practical experience is show, that hardware representation of algorithms ANN is more operative in the plan of speed of numeral transformations of data than their program realization. Therefore we in future will be interested exactly by hardware representation as electronic devices which will be used for the decision of tasks of technique with application of vehicle ANN. For planning of device, which will realize an algorithms of ANN more than is necessary explore architecture neuron nets.

II. FOUND PART

For this purpose it is possible to apply the already approved technological package MatLab 7.0.1. [2] Possibilities of the given package provide teaching ANN, testing as a result of which it is possible to adopt conclusions about expedience of hardware representation of the developed program mean. In addition, the system MatLab from the point of view possibility of forming of dynamic library causes interest, as *.dll - file which can be a basis in writing of driver for the device, that is designed. Such approach gives possibility to promote efficiency of co-operation of the operating system, driver and device. After research ANN in MatLab it is possible to proceed to planning of device. For today, there are a lot of computer-aided designs which allow to design electronic devices of a different complication, functionality with the use of any element base.

Hardware representation ANN foresees the use of digital signal processors (DSP) or programmable logical matrices (PLM). Possibility of planning of devices on PLM is allowed by the systems VHDL, Protel. [3] They it is enough widely approved, that enables to speak about authenticity to the process of planning.

Generally process of planning of devices, beginning with planning of architecture ANN is enough bulky. In addition, it is necessary to foresee possibilities to test a device. Therefore it is suggested to automatic the process of planning of electronic devices of the given type, due to the interface of the system MatLab and VHDL. For research of the given problem, in our view, it is necessary:

- To specify the methods of construction and research ANN in the system MatLab;

- To define an element base and methods for construction of device in the system VHDL;

- To define methods and methods of quality (reliability of functioning) control of device;

- To develop the conceptual model of transformation of architecture ANN from the system MatLab in a functional diagram in the system VHDL with facilities of diagnostics;

- To develop the forming method of principle chart of

device in the system VHDL, built on realization of algorithms ANN.

- To develop facilities of interface of the systems MatLab and VHDL.

Planning of devices and systems of functional electronics, what will realize algorithms the ANN difficult and labour intensive process in which choice of concrete algorithm - this only one of a few steps of process of planning. It, as a rule includes: research of subject domain, structural-functional design, topology planning and in. [1]

We will consider one of the simplest artificial neuron networks – one-layered ANN with displacement. On the entrance of such network the great number of signals is given X, on an output we get the great number of signals in. The scales of synapses are plugged in connecting lines. We will present now this ANN in an environment VHDL. For the comfort, for the entrance values we will adopt integers.

The example of construction of structure ANN in VHDL is resulted on fig. 1.

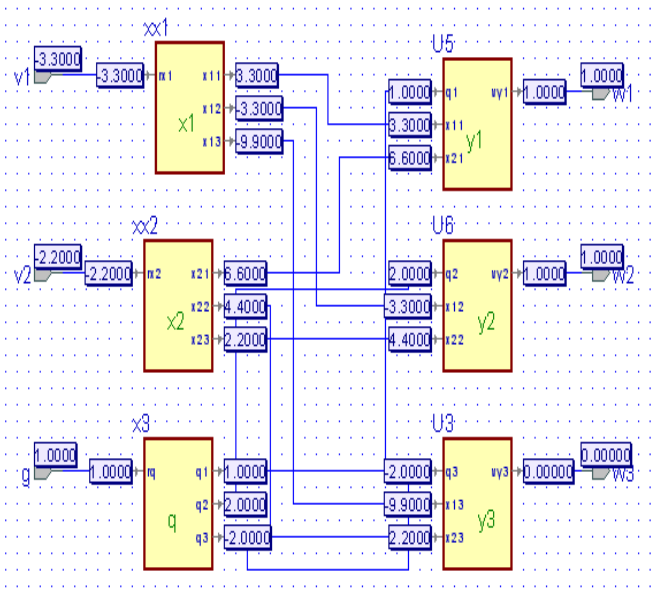

Figure 1. Flow diagram ANN with displacement.

On the given chart every element presents by itself a neuron which has the entrance value. Work of value of neuron by weight of his arc is the outputs of element, that is the characteristic feature of description of elements in VHDL, and also that that on the entrance we can give not only two values but also numbers of real type. Giving on the entrance of network different values and comparing them to truth table. We can check up the rightness of work of network.

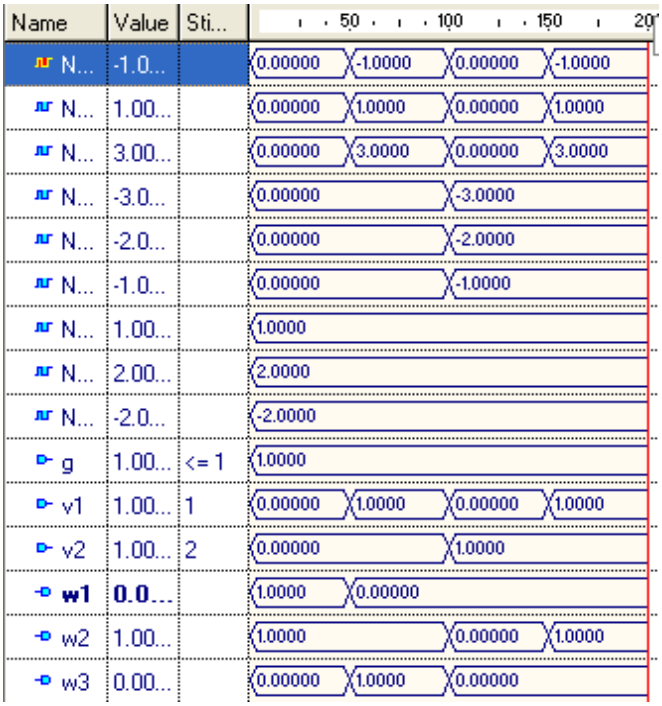

Figure 2. Diagram of chart for two values.

Conducting a precipice in turn, each of arcs, we will get truth table, the values of which substantially will differ from the values of truth tables, one-layered and the three-layered neuron networks with displacement and different types of activating functions. If on the entrances of h1 and h2 to set all possible combinations of binary (fig. 2) and actual numbers (fig. 3), by such function next diagrams will be presented.

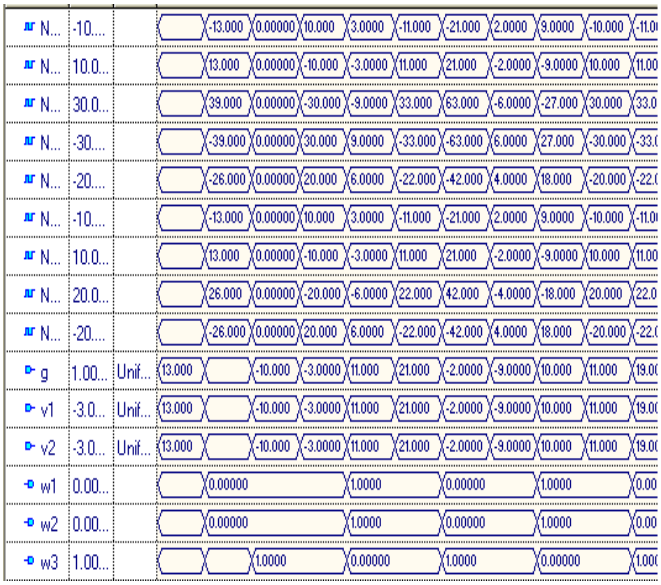

Figure 3. Diagram of chart for the actual values.

Now for an example and for the receipt of evident of testing we will choose the value: v1=-3.3; v2=-2.2 (fig. 4). Thus on an output we will matter: w1=1; w2=1; w3=0, which coincide with the values of truth tables.

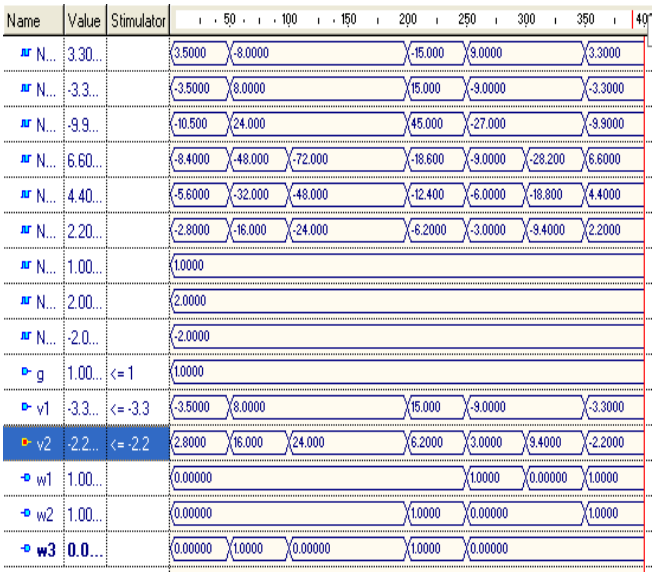

Figure 4. Diagram of chart for the beforehand set values.

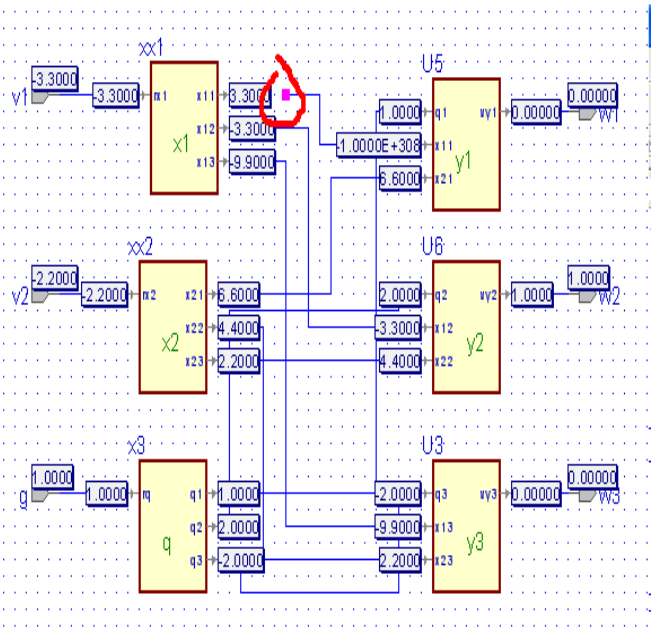

Figure 5. Disconnection the arcs of neuron of one-layered ANN with displacement.

At a conditional precipice on h11 and at the same entrance data: v1=-3.3; v2=-2.2 on outputs we will get: w1=0; w2=1; w3=0 (fig. 5). At a precipice on h13 at the same entrance data also on outputs we will get: w1=0; w2=1; w3=0.

Conducting a precipice in turn, each of arcs, we will get truth (in Table I) table, the values of which substantially differ from the values of truth table of normal work of one-layered neuron network with displacement with activating Boolean function by the neurons.

TABLE I. TRUTH TABLE OF WORK ANN WITH DISPLACEMENT WITH THE PRECIPICE OF SYNAPSES

X1	X2	Y1	Y2	Y3
0(*x11)	0	0	1	0
1(*x11)	0	0	1	1
0(*x11)	1	0	0	0
1(*x11)	1	0	1	0
0(*x12)	0	1	0	0
1(*x12)	0	0	0	1
0(*x12)	1	0	0	0
1(*x12)	1	0	0	0
0(*x13)	0	1	1	0
1(*x13)	0	0	1	0
0(*x13)	1	0	0	0
1(*x13)	1	0	1	0
0	0(*x21)	0	1	0
1	0(*x21)	0	1	1
0	1(*x21)	0	0	0
1	1(*x21)	0	1	0
0	0(*x22)	1	0	0
1	0(*x22)	0	0	1
0	1(*x22)	0	0	0
1	1(*x22)	0	0	0
0	0(*x23)	1	1	0
1	0(*x23)	0	1	0
0	1(*x23)	0	0	0
1	1(*x23)	0	1	0

Analysing the given table it is possible to do the following conclusions:

- at the precipice of even one entrance arc of element value of which during normal work of network even “1” we will get “0”.

- at the precipice of even one entrance arc of element value of which during normal work of network even “0” we will get “0”.

In the case of disrepair which is caused by the precipice of flow line between neurons, facilities VHDL do not enable exactly to define, which exactly its link functions not correctly. Also VHDL does not enable to us to conduct all necessary mathematical computations with different activating functions for one-layered and three-layered the stratified neuron networks with displacement and without it, and also to explore the conduct of such activating functions, as sigma function, hyperbolical function and others. Therefore, for next researches we use the system MatLab 7.0.1, in particular package Simulink, and we develop a test support as software.

III. CONCLUSION

Some types of neuronet-numerators are developed, which will realize the algorithms of neuron nets of Rosenblatt, one-layered and three-layered neuron nets from displacement in an entrance and hidden layer.

The explored reactions of neuronet-numerators on test sequences in the case of display of the disrepairs related to the presence of precipices of synapses.

The got results can be used for research of conduct of activating functions reaction on disrepair in the structure of neuronet-numerators.

The practical value of results of research consists in the truth tables got by means imitation design, which it is possible to use on the stage of planning of neuronet-numerators with the explored activating functions.

The offered method in the process of development of architecture ANN gives possibility the conduct researches of functional possibilities and possibilities to test a device.

Further researches are conducted, what are related with possibility ascertain interface between MatLab and VHDL.

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